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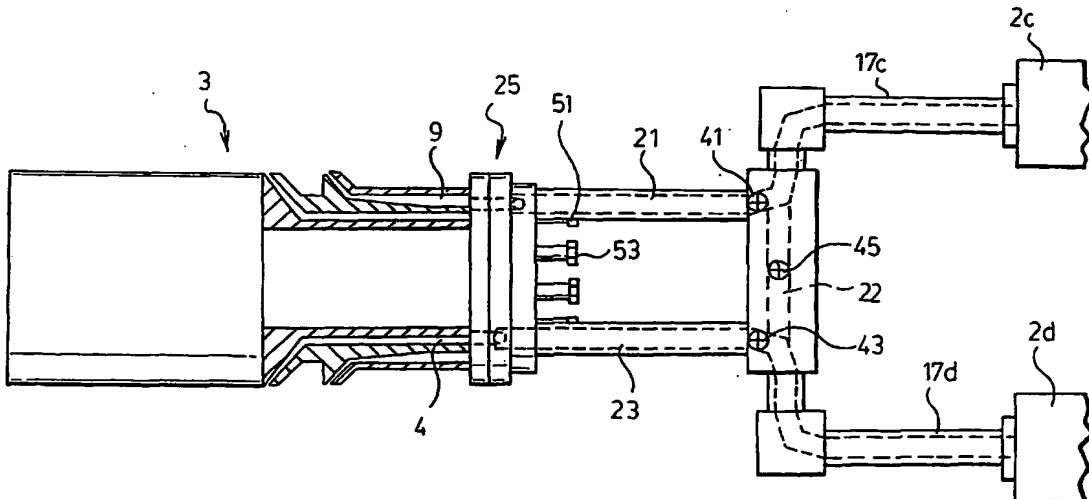
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(54) Title: FLOW DISTRIBUTOR FOR DIE TOOLING OF PIPE MOLD EQUIPMENT WITH REMOTE EXTRUDER



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(57) Abstract: Equipment (1) used in the molding of plastic pipe includes die tooling (3) provided with a plastic flow distributor (25) at the upper end of the die tooling. The plastic flow distributor has adjustable flow to provide an even distribution of plastic from an extruder into at least one die passage (9) within the die tooling.

**FLOW DISTRIBUTOR FOR DIE TOOLING OF PIPE MOLD EQUIPMENT**  
**WITH REMOTE EXTRUDER**

**FIELD OF THE INVENTION**

5       The present invention relates to equipment including an extruder and die tooling used in the molding of plastic pipe.

**BACKGROUND OF THE INVENTION**

10      A traditional plastic pipe molding apparatus includes an extruder which feeds molten plastic directly to one or more interior passages of die tooling which leads to a molding region of the extruder. The one or more die passages can be used to make single or even  
15      ribbed pipe.

The above apparatus suffers from the drawback that the extruder and the die tooling are fixed in position relative to one another. This necessitates relative  
20      large die tool which is expensive and which takes a substantial amount of time to heat. Space saving and heating benefits can be achieved by locating the extruder at a location remote from the die tooling and then using a plastic feed from the extruder to the die tooling.  
25      However, according to known practice, these benefits are more than offset by the fact that with the current design i.e., the design of the extruder being fixed relative to the die tooling the extruder is able to feed directly into the die passage of the tooling. Accordingly,  
30      distribution of the plastic from the extruder around the mouth of the die passage is achieved in a relatively simple manner. The same is not true when working with a remotely located extruder which will not necessarily align directly with the mouth of the die passage.  
35      Accordingly, using existing technology it is very difficult to take advantage of the benefits provided when

- 2 -

separating an extruder from die tooling equipment of a pipe molding apparatus because such separation makes it very difficult to produce an even distribution of molten plastic from the extruder into the die passage. Without 5 such even distribution the resulting pipe is produced with inconsistencies in the wall or walls of the pipe.

SUMMARY OF THE PRESENT INVENTION

The present invention relates to equipment used in 10 the molding of plastic pipe which takes advantage of the benefits achieved by separating an extruder from die tooling without suffering from the drawbacks of such a separation.

15 More particularly, the present invention relates to equipment used in the molding of a plastic pipe in which the equipment comprises a plastic supply providing molten plastic for making the pipe and die tooling which is located remotely of the plastic supply.

20 The die tooling has an internal die passage to carry the molten plastic to a molding region where the pipe is shaped. It further has an upstream end fitted with a flow distributor. The die passage has a ring 25 shaped mouth covered by the flow distributor at the upstream end of the die tooling.

The equipment further includes a plastic feed from 30 the plastic supply to the flow distributor. The flow distributor is then adjustable to produce an even distribution of the molten plastic which it receives from the plastic supply around the ring shaped mouth of the die passage.

35 According to an aspect of the invention the die tooling has multiple passages and the flow distributor

- 3 -

has multiple outlets which are adjustable for each of the die passages.

According to another aspect of the invention the  
5 equipment uses a single extruder which feeds to the multiple flow outlets of the flow distributor. According to yet another aspect of the invention the equipment uses multiple extruders each of which feeds to an individual one of the flow outlets from the flow distributor.

10

According to still another aspect of the invention the equipment uses multiple extruders which can for example, be used to extrude different types of plastic materials. Each of the extruders feeds to each of the  
15 flow outlets from the flow distributor. In this aspect of the invention the equipment further includes valve means to selectively open and close each of the extruders to the flow distributor so that one can choose which one of the extruders is to be used in making the pipe.

20

#### BRIEF DESCRIPTION OF THE DRAWINGS

The above as well as other advantages and features of the present invention will be described in greater detail according to the preferred embodiments of the  
25 present invention in which;

Figures 1, 2 and 3 are all schematic views of equipment used in the molding of plastic pipe according to different embodiments of the present invention;

30

Figure 4 is a front view of the plastic flow distributor used in any one of the embodiments of Figures 1, 2 and 3;

35

Figure 5 is a cross sectional view of the flow distributor of Figure 4 looking through the side of the

- 4 -

flow distributor;

Figure 6 is a sectional view through the flow distributor of Figure 4 when looking from the rear of the  
5 flow distributor;

Figure 7 is a front view of the flow distributor of Figure 4; and

10 Figures 8 and 9 are side and rear views respectively of the flow distributor of Figure 4.

**DETAILED DESCRIPTION ACCORDING TO THE PREFERRED EMBODIMENTS OF THE PRESENT INVENTION IN WHICH:**

15 Figure 1 shows molding equipment generally indicated at 1 used in a pipe molding operation for forming plastic pipe. Equipment 1 comprises an extruder 2 which feeds to die tooling generally indicated at 3. This die tooling receives, as to be described later in  
20 detail, molten plastic from the extruder and delivers it to a mold region (not shown) in which the plastic pipe is formed. Typically this mold region is made up of a plurality of moving mold blocks having profiled faces for shaping the pipe. Located within the mold region is a  
25 cooling plug 7 against which the interior surface of the pipe is formed.

In the embodiment shown, die tooling 3 includes first and second die passages 4 and 9 respectively. Die  
30 passage 4 has a passage outlet 5 and die passage 9 has a passage outlet 11. These two passages which extend longitudinally of the die equipment have a ring like configuration with passage 9 being located outwardly around passage 4. Each of the passages has a ring shaped  
35 mouth at the upstream end of the die tooling 3 which is covered by a plastic flow distributor generally indicated

- 5 -

at 25. This plastic flow distributor is in the form of a plate also to be described later in detail.

As can be seen in Figure 1 of the drawings  
5 extruder 2 is located remotely of die tooling 3. This achieves a number of benefits. Firstly, the die tooling itself is substantially shorter in length than conventional die tooling using an onboard extruder, e.g. the die tooling is probably half the length or less of  
10 conventional die tooling. With this arrangement there are substantial savings with respect to the actual die tooling and furthermore the die tooling is much more easily and quickly heated than conventional die tooling.

15 In addition, the remote location of the extruder 2 relative to die tooling 3 does not require at a single location the large space necessitated by die tooling having an onboard extruder. In contrast, the die tooling itself can be placed in one location with relatively  
20 small space requirements and the extruder can be placed in another location.

According to the present invention a plastic feed generally indicated at 15 extends from extruder 2 to flow  
25 distributor 25. In order to do so the product feed comprises an individual conduit 17 feeding directly off of extruder 2. Conduit 17 eventually leads to branch feed lines 21 and 23 with a connecting branch between branches 21 and 23. A metering device generally  
30 indicated at 19 is provided at the mouth of branch 20 where this connecting extends from branch line 21 to branch line 23.

The plate construction of flow distributor 25  
35 comprises a first plate portion 27 having outlets 29 which align with the mouth of die passage 9. Branch line

- 6 -

21 connects with the flow distributor so as to feed through the outlets 29 of plate portion 27 into die passage 9.

5       The plate construction of the flow distributor further includes plate portion 31 having outlets 33 which align with the mouth of die passage 4 at the upstream end of the die tooling. Branch line 23 connects with plate portion 31 so as to feed through flow distributor outlets 10 33 into die passage 4.

By way of example only, Figure 4 shows the rear surface of flow distributor 25. Here it will be seen that the outlets from the two plate portions are not localized 15 but rather are distributed around the mouths of the two die passages. This is highlighted by the solid line flow path markings of Figure 4. Further features of the flow distributor will be later described with respect to Figures 5 through 9 of the drawings.

20

Returning to Figure 1 the plastic from extruder 2 flows along conduit 17 as far as meter 19. This flow meter which is adjustable for flow distribution purposes will set the amount of molten plastic to flow along line 25 21 and along connecting line 20 to line 23. Line 21 feeding through flow distributor 25 is used to carry plastic to die passage 9 feeding into the mold tunnel through passage outlet 11 in forming part of the pipe wall while line 23 feeds plastic through the flow 30 distributor into passage 4 and out outlet 5 in forming another part of the pipe wall.

Figure 2 shows a further embodiment of the invention in which the equipment uses two extruders 2a and 2b rather than the single extruder shown in Figure 1. This setup uses the same die tooling 3 and same flow

- 7 -

distributor 25. It additionally uses the same branch or feed lines 21 and 23.

What differs between the Figure 1 and Figure 2  
5 embodiments is that in Figure 2, individual conduits 17a and 17b extend from the two extruders 2a and 2b. Conduits 17a feeds directly to branch line 21 which in turn feeds directly to die passage 9. Conduit 17b feeds directly to branch line 23 which then feeds to die  
10 passage 4. There is no connecting passage between the branches 21 and 23. Accordingly in this embodiment one part of the pipe wall is formed from the plastic of one of the extruders and another part of the pipe wall is formed from the plastic of the other extruder.  
15

Another feature of the present invention which is used in both the embodiment of Figure 1 and the embodiment of Figure 2 is the provision of ball  
20 connectors 18 in each of the supply lines. These ball connectors, which regardless of the position in which they are set keep the plastic feed system in a closed condition allowing different positionings of the extruders relative to the die tooling.

25 Figure 3 shows another embodiment of the invention once again using the same die tooling 3 fitted with a flow distributor 25 at the upstream end of the die tooling. The function and fitting of flow distributor 25 relative to the die tooling is identical to that  
30 described with respect to Figures 1 and 2 of the drawings.

In this particular embodiment the equipment includes extruders 2c and 2d. These extruders can be  
35 used to extrude different types of plastic materials to the die tooling. They may also be used for extruding the

- 8 -

same type of material. Furthermore, they can be used simultaneously with one another or they can be used independently of one another.

5 It will be seen that extruder 2c feeds from a conduit 17c out of that particular extruder. Extruder 2d feeds from a conduit 17d. A valve 41 is located in conduit 17c and a valve 43 is located in conduit 17d.

10 Branch lines 21 and 23 feed to flow distributor 25 in the same manner as shown in Figures 1 and 2 of the drawings. A connecting branch 22 connects across the upstream ends of branches 21 and 23. A valve 45 is located in connecting branch 22.

15 By closing valve 45 in connecting branch 22 and by having valves 41 and 43 open the equipment of Figure 3 operates in the same manner as the equipment shown in Figure 2, i.e., conduit 41 feeds along branch 21 to the 20 flow distributor. Conduit 43 feeds along branch 23 to the flow distributor. No plastic is allowed to flow across connecting branch 22. Accordingly, the plastic from extruder 2c is used to make the part of the pipe wall emanating from die passage 9 while extruder 2d is 25 used to make the part of the pipe wall emanating from die passage 4.

In order to make the pipe entirely from the plastic of extruder 2c valves 41 and 45 are opened.  
30 Valve 43 is closed. In this configuration the plastic will flow along conduit 17c past valve 41 and down branch line 21. The plastic will additionally flow along branch line 22 past valve 45 and down branch line 23. The plastic cannot flow past the closed valve 43.

35 If it is desired to make the pipe entirely from

- 9 -

- the plastic of extruder 2d valves 43 and 22 are opened and valve 41 is closed. Under these conditions the plastic from extruder 2d flows along conduit 17d past valve 43 and down branch line 21. The plastic
- 5 additionally flows along branch line 22 where it is diverted by the closed valve 41 into branch line 21.

It will be seen from the description above that even though much of the setup for each of the individual

10 embodiments is consistent from one embodiment to another the equipment itself is extremely adaptive to use a single extruder, multiple extruders and multiple extruders extruding different types of plastic materials. In each of these embodiments the die tooling is the same

15 as is the flow distributor used at the upstream end of the die tooling.

One of the key features to the present invention lies in the fact that the flow distributor and in

20 particular the two plate portions 27 and 31 are adjustable at different locations around each of the plate portions for the most efficient flow of plastic to the die tooling. In Figures 3 and 4 of the drawings it will be seen that the flow distributor 25 includes

25 numerous different adjustment members 51 and 53 which can either be tightened or loosened to adjust the flow to the outlets of the two plate portions relative to the die passage mouths. Note that the adjustments of the plate portions are done independently of one another.

30

For example, the flow of plastic to the flow distributor from each of the extruders will be strongest at the localized location where the plastic enters the flow distributor. However, the plastic must be evenly

35 distributed or spread completely around the ring like mouth of each of the die passages. Therefore the

- 10 -

adjustment means must be setup to decrease the plastic flow at or near the location where the plastic enters the flow distributor and to cause the plastic to flow more evenly to the weaker flow areas at the passage mouth

5   farther away from the source of plastic. The provision of multiple adjustment points around the periphery of the two plate portions of the flow distributor enables the required adjustments at each of the plate portions so as to provide consistent wall thickness around the pipe

10   produced using the equipment.

More specific details with respect to the flow distributor are shown in Figures 5 through 9 of the drawings. For example, Figure 5 clearly shows that the

15   two plate portions 27 and 31 of the flow distributor are integral with one another. Branch line 21 feeds through plate portion 27 along passages 22 which outlet at the openings 29 to the upstream side of the distributor plate. As can be seen in Figure 5 these passages

20   penetrate through both the plate portion 27 and the plate portion 31. Adjustment screws 53 are used to open and close passages 22 to control plastic flow distribution to the inner pipe wall through plate outlet openings 29.

25           Plastic flow branch 23 feeds through passages 24 directly into plate portion 31 bypassing plate portion 27. Passages 24 outlet at openings 33 which feed the plastic for the formation of the outer pipe wall. Adjustment screws 51 are provided in the flow passages 24

30   to adjust plastic distribution around the distributor for the outer pipe wall. Note that even though adjustment members 51 penetrate through pipe portion 27 to plate portion 31 the adjustment of these members does not affect the flow of plastic through passages 22.

35

Figures 8 and 9 show that the adjustment members

- 11 -

51 and 53 are easily accessible from the rear of the flow distributor plate.

Although various preferred embodiments of the  
5 present invention have been described in detail, it will  
be appreciated by those skilled in the art that  
variations may be made without departing from the spirit  
of the invention or the scope of the appended claims.

- 12 -

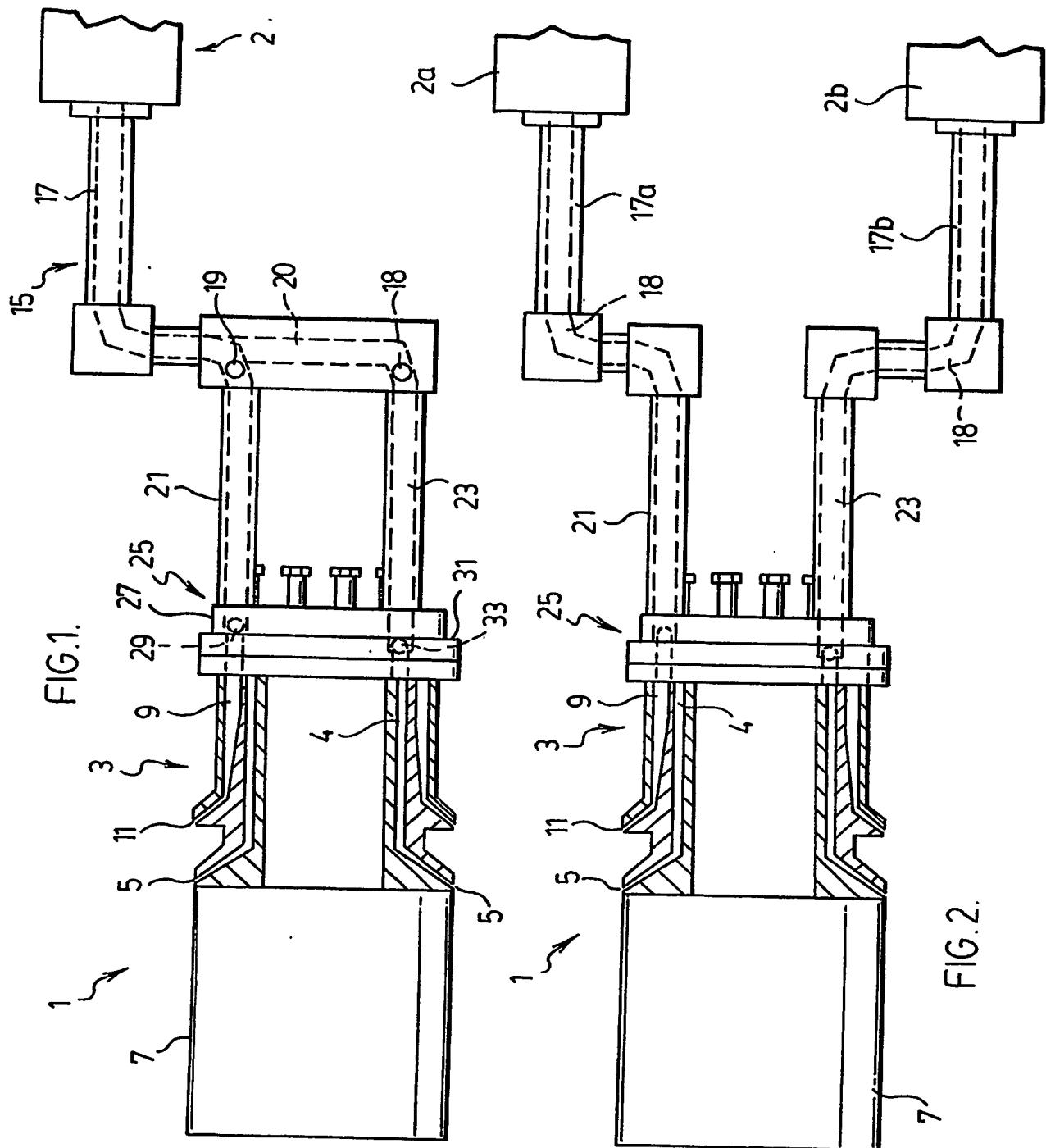
**THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:**

1. Equipment used in the molding of plastic pipe, said equipment comprising a plastic supply which provides molten plastic for making the pipe, die tooling having an internal die passage to carry the molten plastic to a molding region where the pipe is shaped, the die tooling having an upstream end fitted with a flow distributor the die passage having a ring shaped mouth covered by the flow distributor at the upstream end of the die tooling, the plastic supply being located remotely of the die tooling and said equipment including a plastic feed from the plastic supply to the flow distributor, the flow distributor having a first plastic flow path which is adjustable to produce an even distribution of the molten plastic from the plastic supply around the ring shaped mouth of the die passage.
2. Equipment as claimed in Claim 1 wherein said die tooling includes a second die passage having a ring shaped mouth which is outwardly around the mouth of the first die passage and which is also covered by the flow distributor, the flow distributor having a second plastic flow path which is adjustable to produce an even distribution of the molten plastic from the plastic supply around the mouth of the second die passage.
3. Equipment as claimed in Claim 2 wherein said flow distributor comprises a plate secured to the upstream end of said die tooling, said plate including a first plate portion which feeds through the first plastic flow path to the mouth of the first die passage and a second plate portion which feeds second plastic flow path to the mouth of said second die passage, said first and second plastic flow paths both being adjustable and being adjustable independently of one another.

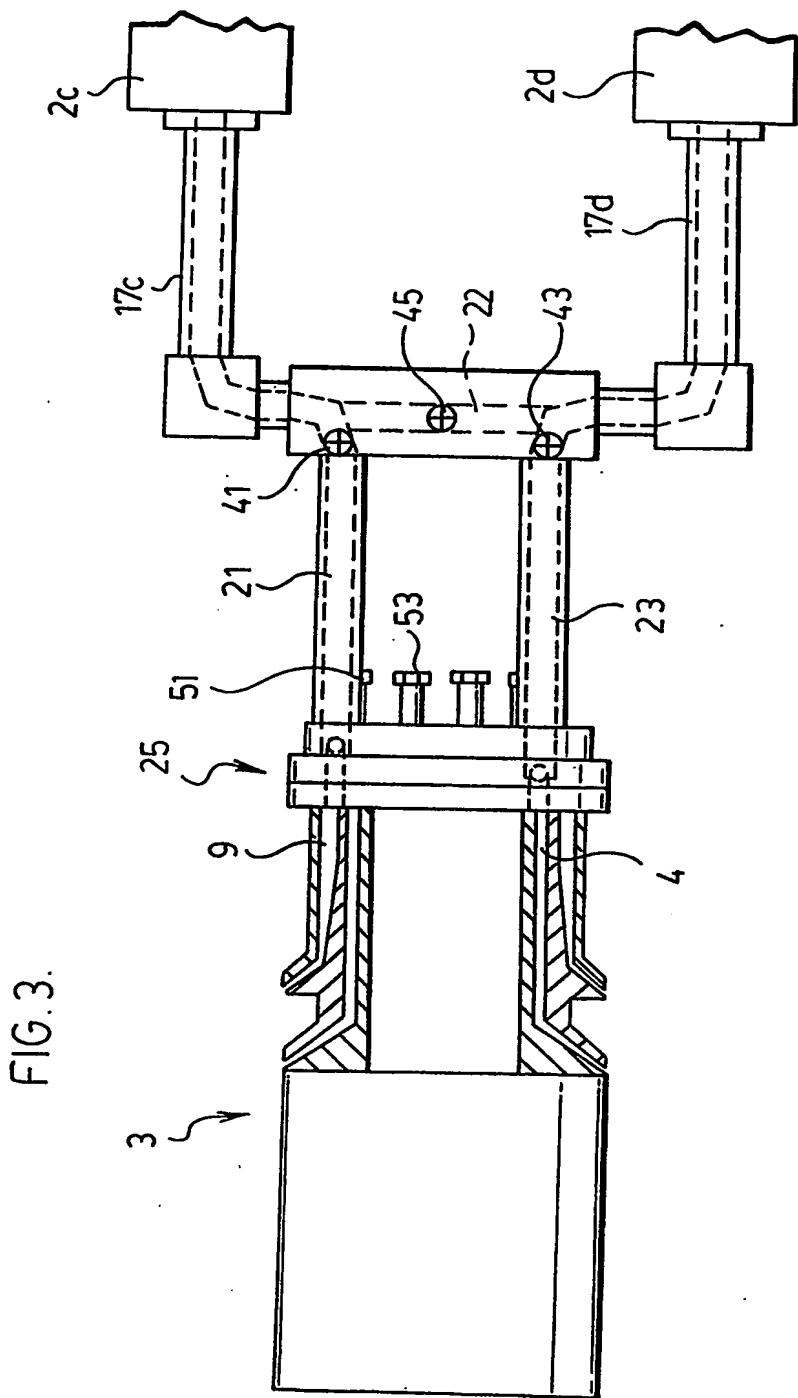
4. Equipment as claimed in Claim 2 wherein said plastic supply comprise a single extruder and wherein said plastic feed comprises a single conduit from said 5 extruder to first and second supply branches of said plastic supply, said first supply branch feeding to the first plastic flow path of the flow distributor around the mouth of the first die passage, the second supply branch feeding to the second plastic flow path of the 10 flow distributor around the mouth of the second die passage.

5. Equipment as claimed in Claim 2 wherein said plastic supply comprises first and second extruders, said 15 plastic feed comprising a first conduit from said first extruder to the first plastic flow path of said flow distributor around the mouth of said first die passage and a second conduit from said second extruder to the second plastic flow path of said flow distributor around 20 the mouth of said second die passage.

6. Equipment as claimed in Claim 2 wherein said plastic supply comprises first and second extruders, said plastic feed comprising a first conduit from said first 25 extruder and a second conduit from said second extruder, a first supply branch feeding to the first plastic flow path of the flow distributor around the mouth of the first die passage, a second supply branch feeding to the second plastic flow path around the mouth of the second 30 die passage, and a connecting branch between said first and second supply branches, both said first and said second conduits from said first and second extruders feeding to said connecting branch of said plastic feed and said plastic supply including flow adjustment means 35 for selecting opening and closing said first and second conduits relative to said connecting branch.



2/6



3 / 6

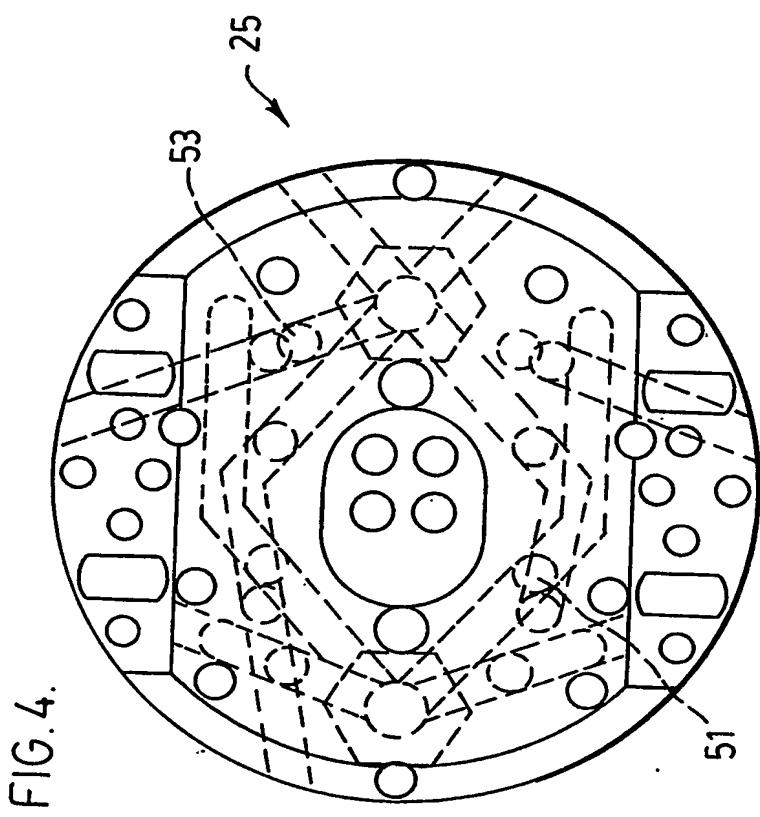


FIG.6.

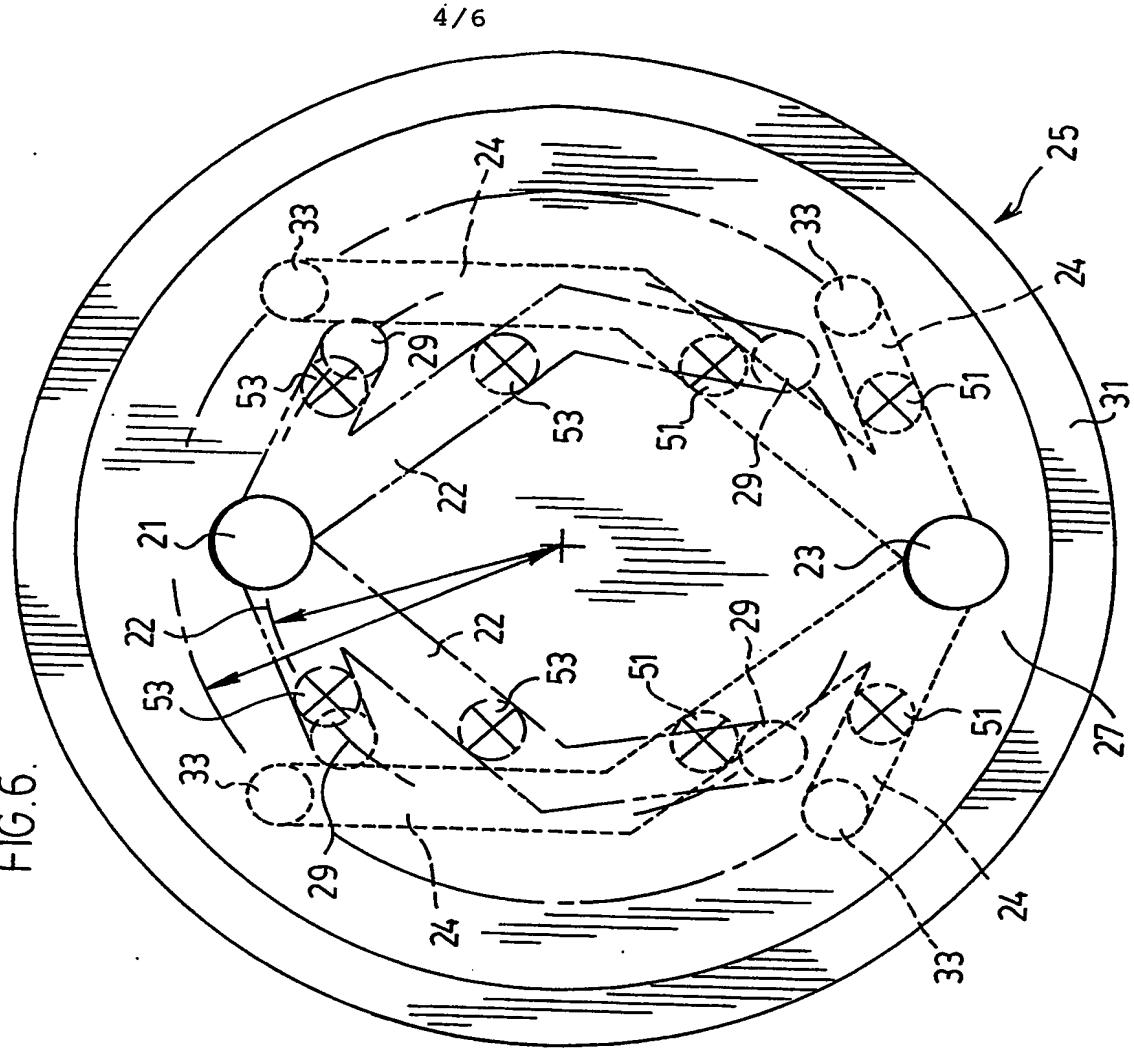
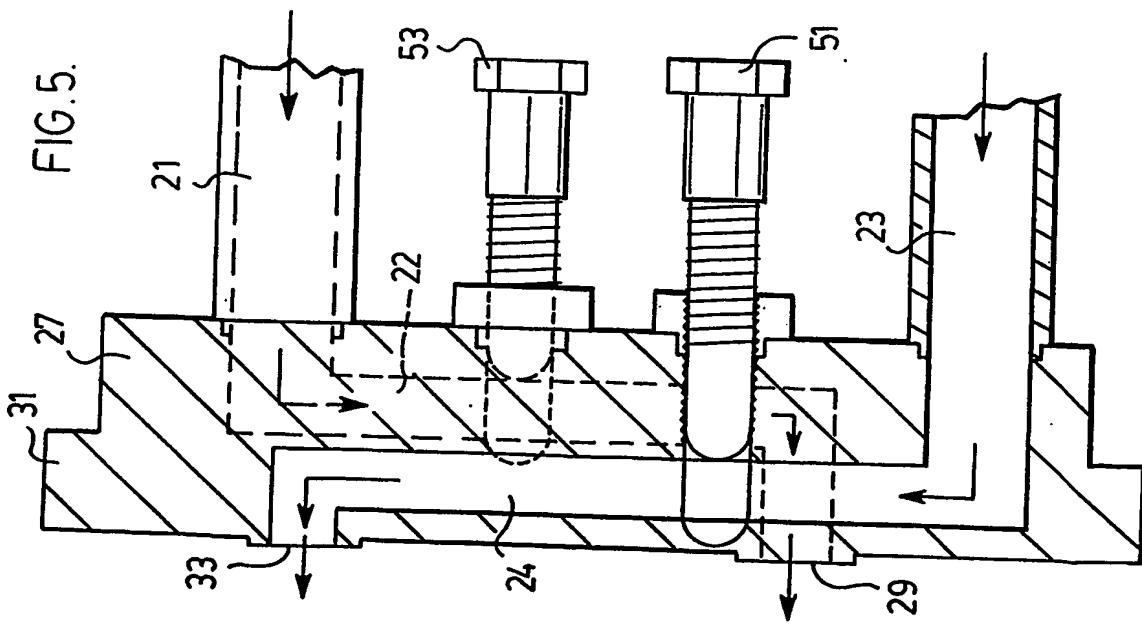


FIG.5.



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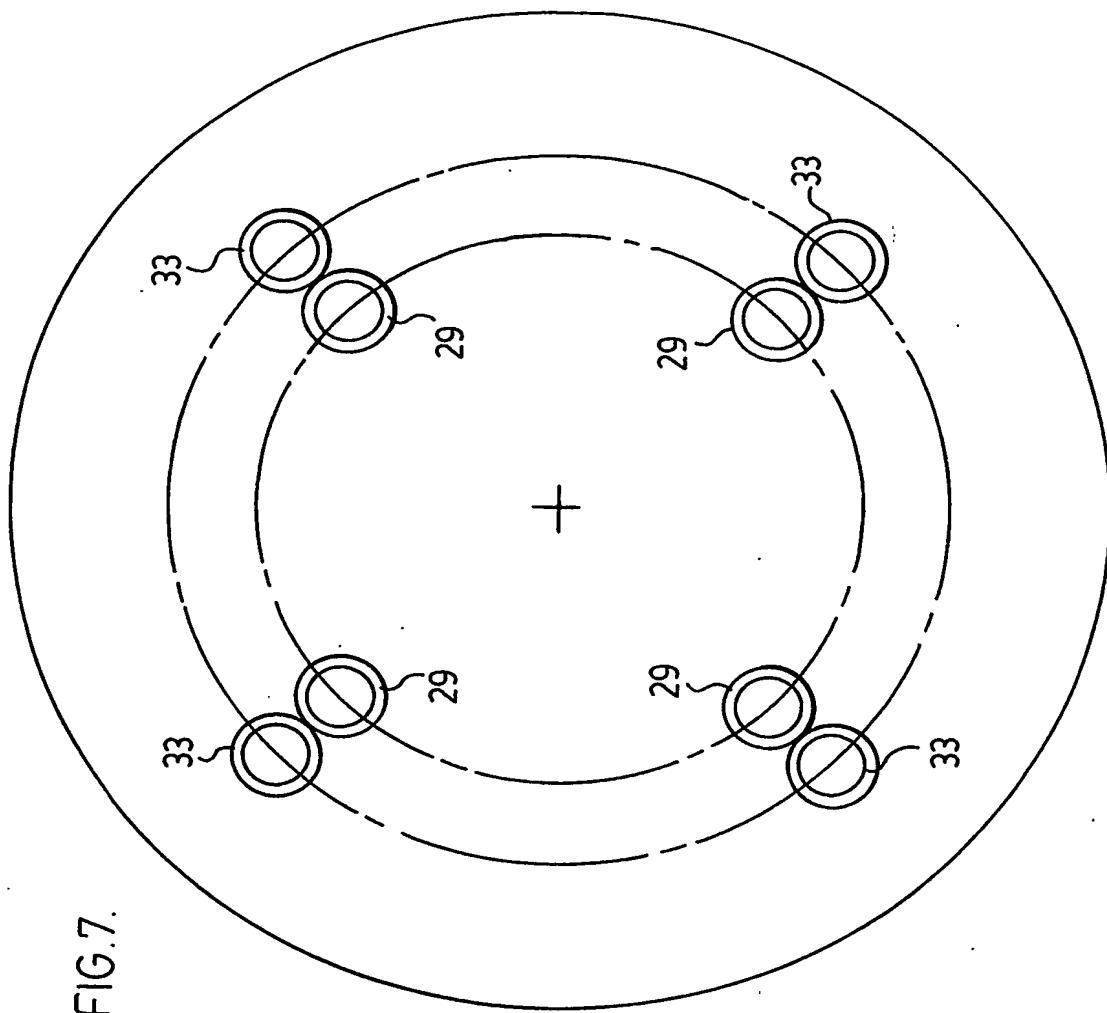


FIG.7.

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FIG. 9.

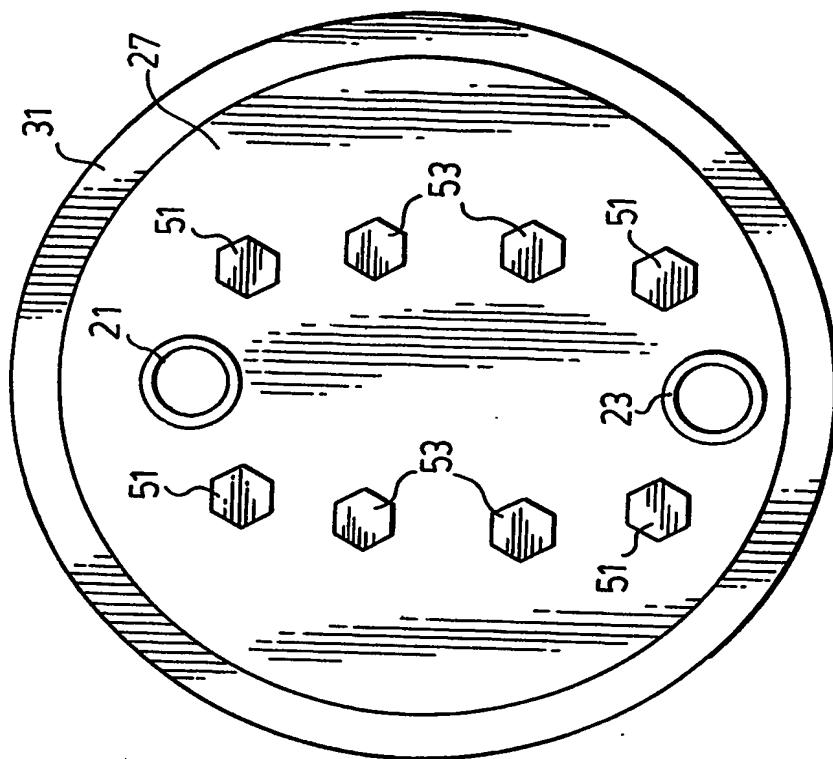
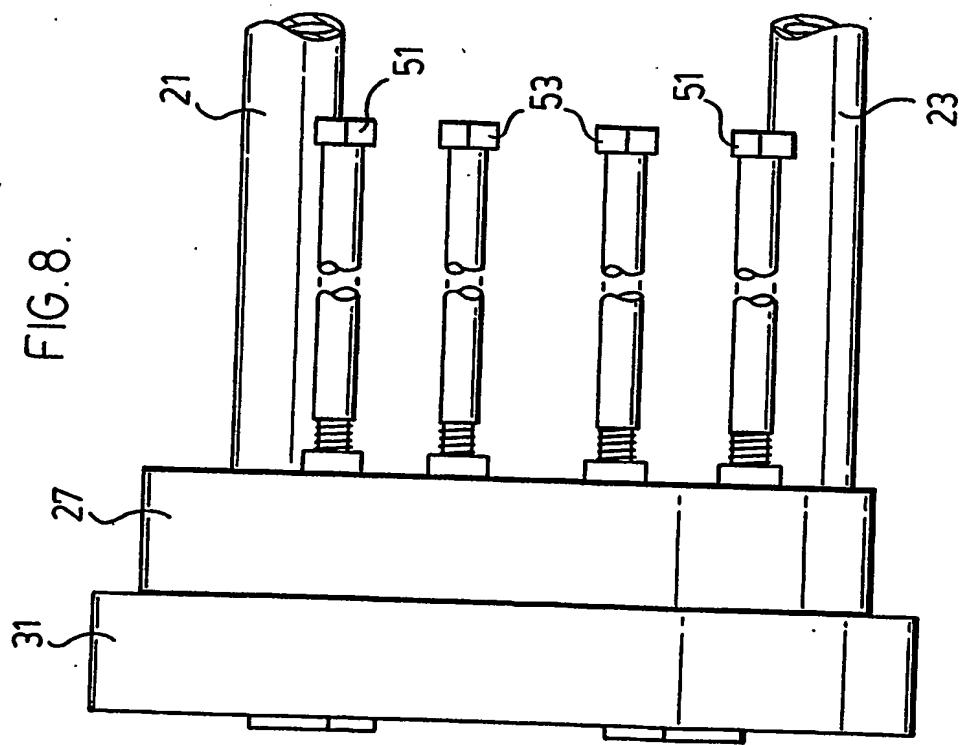


FIG. 8.



# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/CA 03/01957

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 7 B29C47/70 B29C47/58 B29C47/06

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)  
IPC 7 B29C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 00/07801 A (UNICOR ROHRSYSTEME GMBH ; NEUBAUER GERHARD (DE)) 17 February 2000 (2000-02-17) the whole document	1-6
A	WO 86/05437 A (UPONOR AB) 25 September 1986 (1986-09-25) page 3, line 18 - page 4, line 30; figures 3-5	1-6
A	DE 295 17 378 U (DROSSBACH GMBH & CO KG) 29 February 1996 (1996-02-29) the whole document	1-6

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

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Date of the actual completion of the International search

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## INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No.

PCT/CA 03/01957

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